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CLOSURE STRATEGY

NEVADA TEST SITE
AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE

Revision 0

Prepared by

National Security Technologies LLC

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ACRONYMS and ABBREVIATIONS

BN	Bechtel Nevada
CA	Composite Analysis
CAU	Corrective Action Unit
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
ET	evapotranspirative; evapotranspiration
FFACO	*Federal Facility Agreement and Consent Order*
ft	foot; feet
FY	fiscal year
GCD	Greater Confinement Disposal
ICMP	Integrated Closure and Monitoring Plan
LFRG	Low-Level Federal Review Group
LLMW	Low-Level Mixed Waste
LLW	Low-Level Waste
MTRU	Mixed Transuranic
MWDU	Mixed Waste Disposal Unit
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
PA	Performance Assessment
RCRA	Resource Conservation and Recovery Act
RWMS	Radioactive Waste Management Site
TFRG	Transuranic Federal Review Group
TRU	transuranic

1.0 INTRODUCTION

This paper presents an overview of the strategy for closure of part of the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site (NTS), which is about 65 miles northwest of Las Vegas, Nevada (Figure 1). The Area 5 RWMS is in the northern part of Frenchman Flat, approximately 14 miles north of Mercury. The Area 5 RWMS encompasses 732 acres subdivided into quadrants, and is bounded by a 1,000-foot (ft)-wide buffer zone. The northwest and southwest quadrants have not been developed. The northeast and southeast quadrants have been used for disposal of unclassified low-level radioactive waste (LLW) and indefinite storage of classified materials.

This paper focuses on closure of the 38 waste disposal and classified material storage units within the southeast quadrant of the Area 5 RWMS, called the "92-Acre Area." The U.S Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office (NNSA/NSO) is currently planning to close the 92-Acre Area by 2011. Closure planning for this site must take into account the regulatory requirements for a diversity of waste streams, disposal and storage configurations, disposal history, and site conditions. For ease of discussion, the 92-Acre Area has been subdivided into six closure units defined by waste type, location, and similarity in regulatory requirements. Each of the closure units contains one or more waste disposal units; waste disposal units are also called waste disposal cells.

The paper provides a brief background of the Area 5 RWMS, identifies key closure issues for the 92-Acre Area, recommends actions to address the issues, and provides the National Security Technologies, LLC (NSTec), schedule for closure.

This paper is not intended to be an exhaustive analysis of the regulatory compliance strategy. The Performance Assessment (PA)/Composite Analysis (CA) process, as well as past characterization and interim planning efforts, address in detail many of the specific containment, assurance, and other requirements and provide the technical support for closure planning. Details of the closure strategy will be developed and presented in the final Closure Plans and Addenda as part of the approved, funded annual work scope and Life Cycle Baseline.

2.0 AREA 5 RWMS BACKGROUND

2.1 HISTORY

Radioactive waste burial operations in Area 5 began in January 1961, prior to formal establishment of the Area 5 RWMS, at the Sugar Bunker Waste Dump. DOE waste disposal records indicate that the Sugar Bunker Waste Dump received material primarily from on-site generators. The dump was divided into classified material storage and unclassified waste disposal areas, and consisted of shallow excavated pits and trenches.

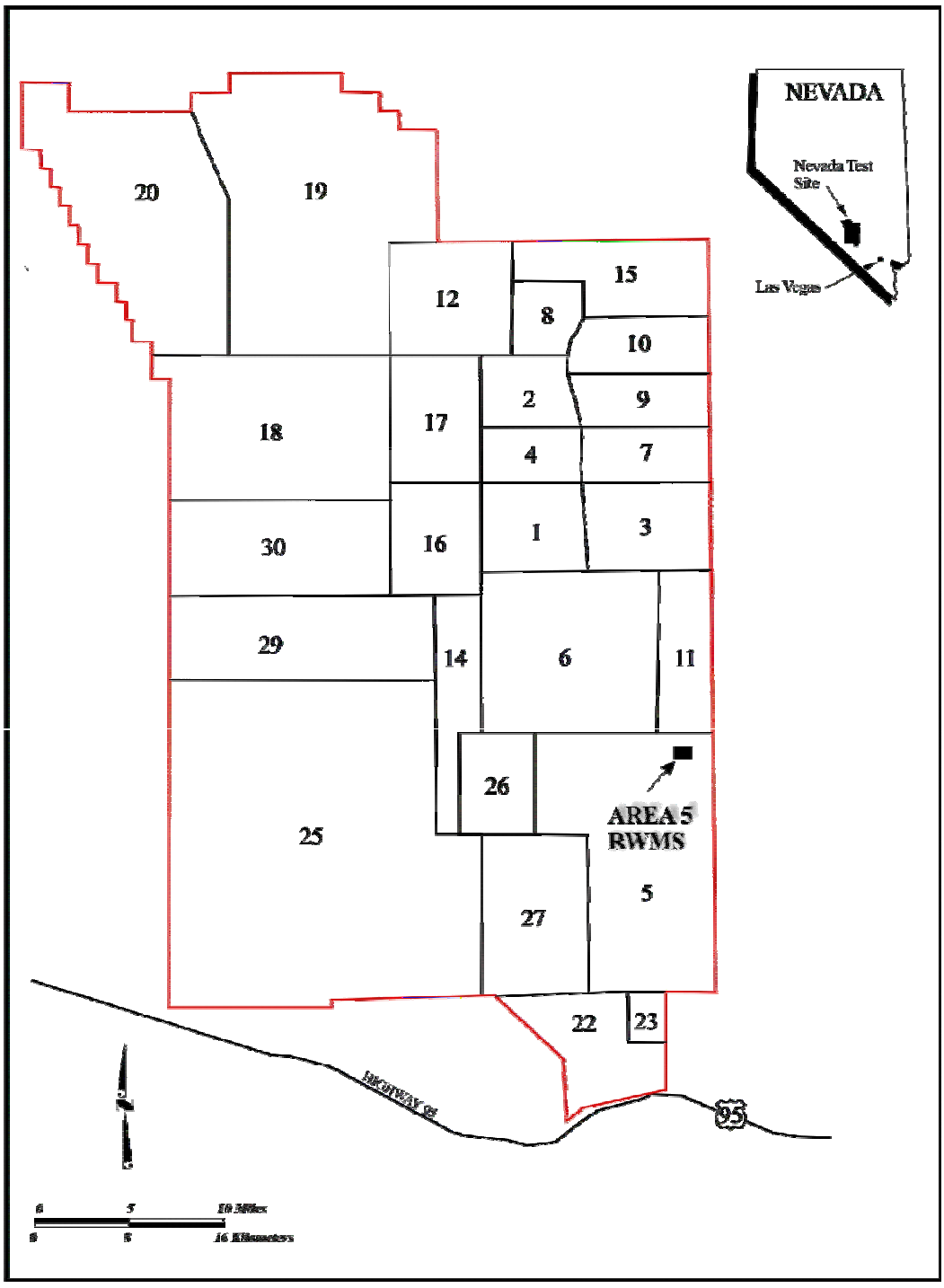

Figure 1
Area 5 Radioactive Waste Management Site Location

The DOE implemented the NTS Waste Management Program and established the Area 5 RWMS in 1978. The southeast quadrant of the Area 5 RWMS encompassed the existing Sugar Bunker Waste Dump, which then consisted of eight full and operationally closed trenches and one active trench. All of these original Sugar Bunker Waste Dump waste disposal units are now part of Corrective Action Unit (CAU) 111 (Figures 2 and 3). Original disposal unit designations are shown in parentheses on Figure 3.

With establishment of the Area 5 RWMS, the NTS began to dispose greater amounts of waste from off-site DOE generators. More pits and trenches were developed as needed.

Waste disposal history is summarized in detail in several documents, including:

- *Integrated Closure and Monitoring Plan for the Area 3 and Area 5 Radioactive Waste Management Sites at the Nevada Test Site* (Bechtel Nevada [BN], 2005a)

- *Characterization Report for the 92-Acre Area of the Area 5 Radioactive Waste Management Site, Nevada Test Site, Nevada* (BN, 2006)

- *Waste Inventory and Preliminary Source Term Model for the Greater Confinement Disposal Site at the Nevada Test Site* (Chu and Bernard, 1991 [reprinted for unlimited release in 1998]).

2.2 OPERATIONAL STATUS

The 92-Acre Area contains 25 shallow excavated pits and trenches and 13 Greater Confinement Disposal (GCD) boreholes (Figure 3). The pits and trenches range in depth from approximately 15 to 48 ft, and have been used to dispose unclassified LLW, low-level mixed waste (LLMW), and asbestiform waste; and to indefinitely store classified low-level and low-level mixed materials. A small quantity of classified transuranic (TRU) materials was inadvertently buried in one trench in 1986 (Dickman, 1989). The GCD boreholes are intermediate-depth disposal and storage units, 10 to 12 ft in diameter and about 120 ft deep. Unclassified GCD boreholes include high-specific-activity LLW, whereas the classified GCD boreholes include high-specific-activity low-level, TRU, and mixed TRU (MTRU) materials. Classified materials storage units are designated with a "C" and unclassified waste disposal units are designated with a "U" at the end of the name. The classified materials storage units are primarily in the middle of the site, flanked to the north, south, and west by unclassified waste disposal units.

With the exception of three disposal units, all of the pit and trench disposal/storage units within the 92-Acre Area are covered with native soil approximately 8 ft thick. Pits P03U, P06U, and P09U are active. The Pit P03U Mixed Waste Disposal Unit (MWDU) operates under Resource Conservation and Recovery Act (RCRA) Interim Status. The Nevada Division of Environmental Protection (NDEP) will allow the NNSA/NSO to continue to operate Pit P03U under Interim

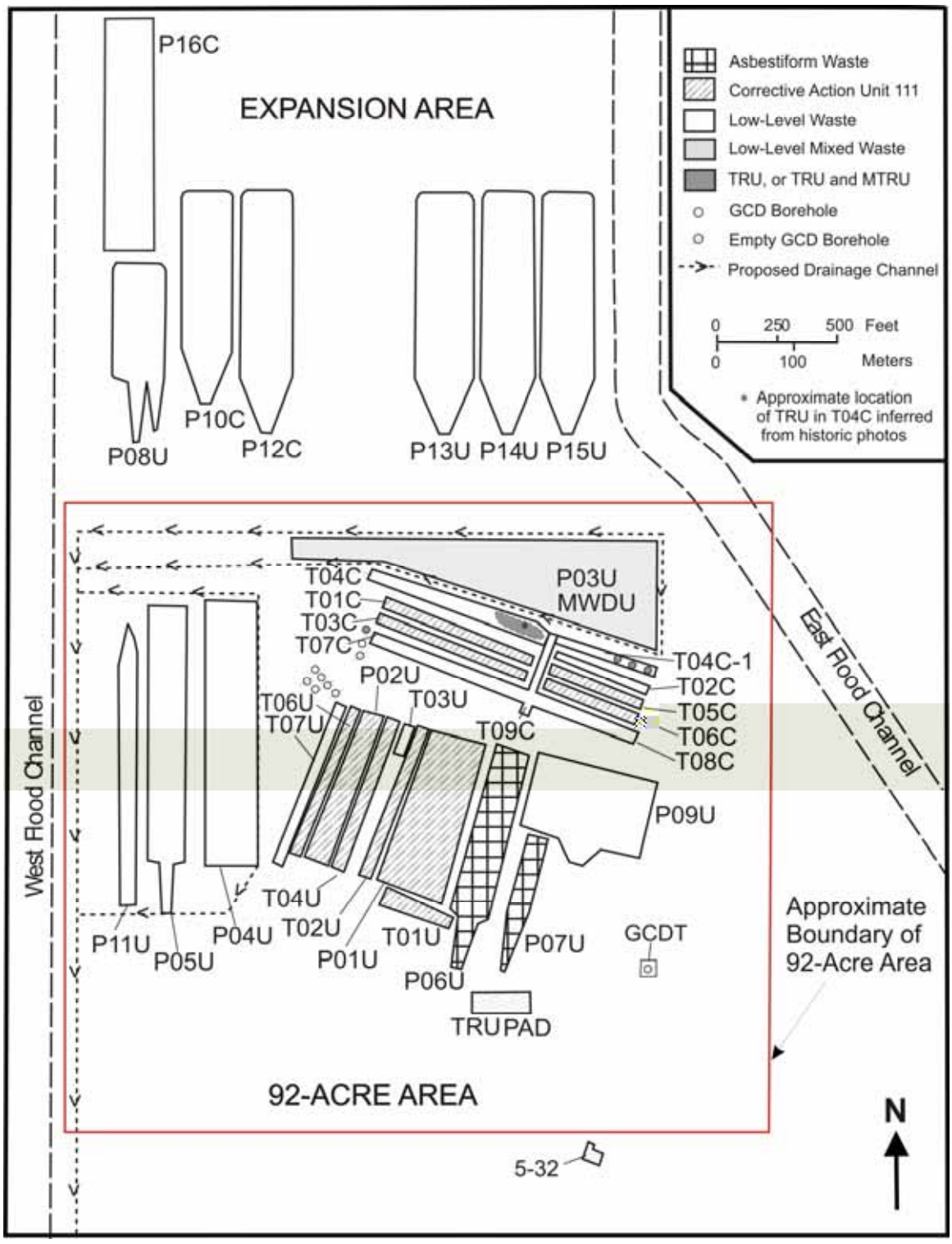

Figure 2
Area 5 Radioactive Waste Management Site

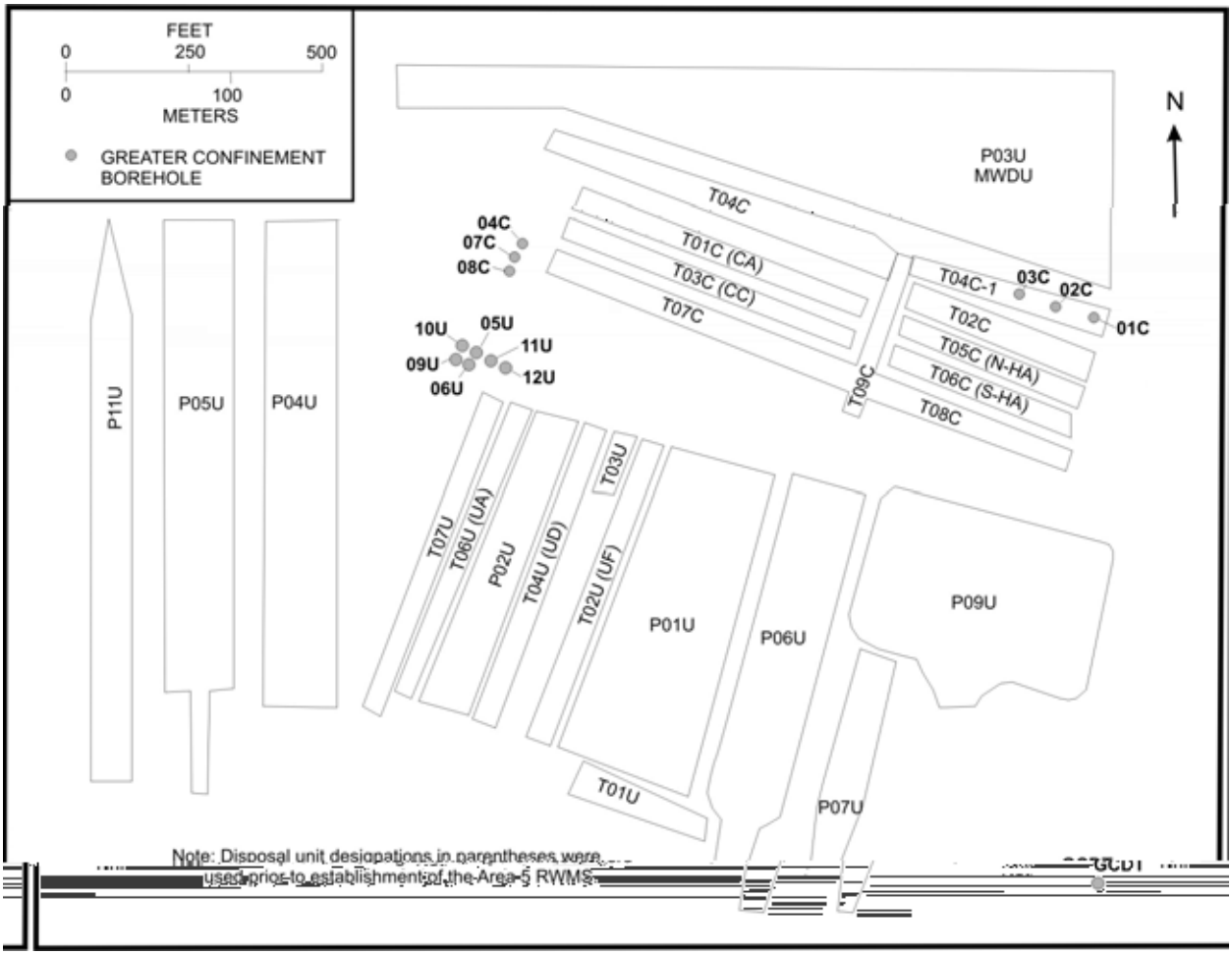

Figure 3
Greater Confinement Disposal Borehole Locations

Status for a period not to exceed five years and to accept up to 706,293 additional cubic feet of LLMW from on-site and off-site generators. The end of operation of the Pit P03U MWDU under Interim Status is anticipated to be before December 1, 2010. Because the volume of the forecasted LLMW will not use all the capacity, Pit P03U may be reclassified to receive both LLW and LLMW.

The lowest tier of Pit P06U was used for disposal of thorium waste. Pit P06U currently accepts asbestiform waste under state of Nevada Solid Waste Disposal Site Permit SW 1300001 (NDEP, 2000). Minor changes to the permit application were approved by the NDEP in 2006. Because the volume of the forecasted asbestiform waste stream is low, Pit P06U may be reclassified to receive both LLW and asbestiform waste. Pit P09U is a LLW disposal unit nearing capacity. Pits P06U and P09U are likely to be operationally closed before Pit P03U completes operations.

Seven of the 13 GCD boreholes (GCDT, GCD-01C, GCD-02C, GCD-03C, GCD-04C, GCD-05U, and GCD-10U) are full of waste or material to approximately 70 ft depth and are operationally closed with 70 ft of native soil cover to grade. Two of the boreholes (GCD-06U and GCD-07C) are partially filled with waste or material, but are inactive. Four of the boreholes (GCD-08C, GCD-09U, GCD-11U, and GCD-12U) were not used and remain empty.

3.0 CLOSURE

3.1 CLOSURE UNIT DESCRIPTIONS AND APPLICABLE REGULATIONS

Closure of the Area 5 RWMS 92-Acre Area disposal units will be in accordance with the requirements under which each disposal unit is regulated. For ease of discussion, six closure units have been defined by waste type, location, and similarity in regulatory requirements:

- LLW Unit
- CAU 111
- Asbestiform LLW Unit
- Pit 3 MWDU
- TRU GCD Borehole Unit
- TRU Trench Unit

Each closure unit contains one or more waste disposal and/or classified material storage units. Table 1 shows disposal and storage units in each closure unit, and summarizes the proposed closure path for each closure unit. CAU 111 is currently listed in the *Federal Facility Agreement and Consent Order* (FFACO, 1996) and in RCRA Part B Permit NEV HW0021 (NDEP, 2005). The Pit 3 MWDU will be closed under RCRA permit requirements. An interim Closure and Post-Closure Care Plan was published in December 2005 (NNSA/NSO, 2005a).

Regulatory interpretations by the NNSA/NSO may be required to address the TRU closure units. Closure of the GCD boreholes containing potential MTRU materials is currently assumed to fall under both RCRA and DOE requirements.

Closure regulations applicable to all or selected closure units are presented in:

- DOE Order 435.1 and DOE Manual M 435.1-1A
- Title 40 CFR 191
- Title 40 CFR 265
- Nevada Administrative Code (NAC) 444.743
- RCRA requirements as incorporated into NAC 444.8632
- FFACO

Table 1
Area 5 RWMS 92-Acre Closure Units and Waste Units

Closure Unit	Waste Unit	Status of Operations (Dec 2005)	Waste Type/ Material	Principal Closure Regulations	Path to Closure	Approval Authority
LLW Unit	P04U	Soil Cover	LLW	DOE O 435.1	Approved PA/ICMP; Closure Report; recommend NNSA/NSO approval authority	NNSA/NSO
	P05U	Soil Cover				
	P09U	Active				
	P11U	Soil Cover				
	T03U	Soil Cover				
	T07U	Soil Cover				
	T02C	Soil Cover				
	T07C	Soil Cover				
	T08C	Soil Cover				
	T09C	Soil Cover				
	GCDT	Soil Cover				
	GCD-05U	Soil Cover				
	GCD-06U	Open, full				
	GCD-07C	Open, full				
	GCD-08C	Open, empty				
	GCD-09U	Open, empty				
	GCD-10U	Soil Cover				
	GCD-11U	Open, empty				
	GCD-12U	Open, empty				
Asbestiform Unit	P06U	Active	Asbestiform/LLW	NV Solid Waste Disposal Site Permit #SW 1300001	As per the permit; Closure Plan; Closure Report	NDEP, BOFF
	P07U	Soil Cover				

Table 1
Area 5 RWMS 92-Acre Closure Units and Waste Units
(continued)

Closure Unit	Waste Unit	Status of Operations (Dec 2005)	Waste Type/ Material	Principal Closure Regulations	Path to Closure	Approval Authority
TRU GCD Borehole Unit	GCD-01C	Soil Cover	TRU, MTRU	Title 40 CFR 191 TFRG Criteria	PA conditions met. Addendum to PA for TFRG approval; Closure Plan; Closure Report	TFRG (DOE/HQ)
	GCD-02C	Soil Cover	TRU, MTRU?			
	GCD-03C	Soil Cover	TRU, MTRU?			
	GCD-04C	Soil Cover	LLW, LLMW, TRU, MTRU			
	T04C-1	Soil Cover	LLW (trench overlies three GCD boreholes)			
TRU Trench Unit	T04C	Soil Cover	LLW, TRU (1.2 kilograms inadvertently disposed in 1986)	Title 40 CFR 191 TFRG Criteria Risk-informed process (subject to DOE approval of National Academy of Sciences recommendations)	Closure Plan; Closure Report	EPA/HQ TFRG (DOE/HQ)

Table 1
Area 5 RWMS 92-Acre Closure Units and Waste Units
(continued)

Closure Unit	Waste Unit	Status of Operations (Dec 2005)	Waste Type/ Material	Principal Closure Regulations	Path to Closure	Approval Authority
CAU 111 Unit	P01U	Soil Cover	LLW/suspected LLMW	FFACO, Title 40 CFR 265	Characterization Report; Closure Plan; Closure Report	NDEP, BOFF
	P02U	Soil Cover				
	T01U	Soil Cover				
	T02U	Soil Cover				
	T04U	Soil Cover				
	T06U	Soil Cover				
	T01C	Soil Cover				
	T03C	Soil Cover				
	T05C	Soil Cover				
	T06C	Soil Cover				
Pit 3 MWDU	P03U	Active	LLMW	Title 40 CFR 265	As per the Closure Plan; Closure Report	NDEP, BOWM

NOTES:

BOFF	Bureau of Federal Facilities
BOWM	Bureau of Waste Management
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
HQ	Headquarters
ICMP	Integrated Closure and Monitoring Plan
LLW	Low-Level Waste
LLMW	Low-Level Mixed Waste
MTRU	Mixed Transuranic
MWDU	Mixed Waste Disposal Unit
NDEP	Nevada Division of Environmental Protection
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
RCRA	Resource Conservation and Recovery Act
TFRG	TRU Federal Review Group
TRU	Transuranic

The DOE's performance requirements meet or exceed many of EPA's closure requirements for hazardous waste landfills.

Monitoring regulations applicable to all or selected closure units are included in:

- DOE Order 435.1 and DOE Manual M 435.1-1A
- Title 40 CFR 61
- Title 40 CFR 191
- Title 40 CFR 264
- Title 40 CFR 265

Regulatory requirements for closure and monitoring are detailed in the *Integrated Closure and Monitoring Plan for the Area 3 and Area 5 Radioactive Waste Management Site at the Nevada Test Site* (BN, 2005a), and the *Characterization Report – Operational Closure Covers for the Area 5 Radioactive Management Site at the Nevada Test Site* (BN, 2005b).

Groundwater monitoring will continue at the Area 5 RWMS in accordance with RCRA permit requirements. However, the NNSA/NSO may seek concurrence from the NDEP to discontinue groundwater monitoring in the future. Discontinuation of groundwater monitoring is justified because there is no significant potential for migration of liquid from the Pit P03U MWDU to the uppermost aquifer during the active life of the facility or the 30-year post-closure care period under RCRA (Shott et al., 1998; BN, 2000).

Issues of regulatory interpretation are further addressed in Section 3.4.

3.2 CHARACTERIZATION

Site characterization provides the data needed to design the final cover system, demonstrate compliance with performance and assurance requirements, and develop the closure plans and post-closure monitoring and maintenance plans. The site characterization steps are outlined in the ICMP (BN, 2005a).

Extensive characterization and monitoring of the Area 5 RWMS conducted over the past two decades provide input to the PA and CA. Data Quality Objectives (DQOs) of the PA and CA are coupled to characterization and monitoring. The PA/CA maintenance process provides an ongoing method to identify data needs and modify characterization and monitoring programs to meet the performance objectives of DOE Order 435.1. The NNSA/NSO believes that existing data are sufficient to plan and implement closure of the 92-Acre Area. Summary information is presented in the *Characterization Report for the 92-Acre Area of the Area 5 Radioactive Waste Management Site, Nevada Test Site, Nevada* (BN, 2006) and also in the PA (Shott et al., 1998) and CA (BN, 2000). A PA was also conducted for GCD boreholes containing TRU materials (Cochran et al., 2001).

The Low-Level Federal Review Group (LFRG) and the TFRG provide ongoing input on the adequacy of data supporting facility PAs through the PA/CA maintenance process.
Items that may require additional work include:

- Presentation of classified inventory data and security information. Volumes and radiological character are summarized in closure inventory projections in the PA (Shott et al., 1998) and CA (BN, 2000). Security information is found in the Documented Safety Analysis (NNSA/NSO, 2004).

- Recalculation of the Area 5 flood potential to support nuclear facility requirements.

- Probabilistic modeling to optimize cover design thickness, supplement previous assessments, and incorporate updated inventory assumptions.

- Probabilistic modeling to support PA of TRU materials in Trench T04C and GCD boreholes.

- A proposal to use an FFACO strategy for institutional controls may be presented to LFRG in 2007. This may affect criteria for optimization of cover thickness.

3.3 CLOSURE PROCESS

The general closure process steps include:

- Develop, review, and accept the Closure Plans and Addenda (see below), including provisions for post-closure monitoring and maintenance, using the results of the site characterization.

- Implement the Closure Plans, including design and construction of the final cover and drainage.

- Prepare the Closure Reports.

- Submit the Closure Reports for review and acceptance.

- Acquire acknowledgement of closure (may be via acceptance of the Closure Reports).

- Conduct post-closure monitoring and maintenance in accordance with the approved Closure Plan.

Adequate characterization data are available to proceed with the design of a final closure cover and for continued closure planning; formal concurrences must be acquired from the NDEP for CAU 111, the Pit P03U MWDU, and the GCD boreholes that contain MTRU. The schedule for closure assumes that the NDEP will accept the *Characterization Report for the 92-Acre Area of the Area 5 Radioactive Waste Management Site, Nevada Test Site* (BN, 2006) and recommend

development of a Closure Plan for CAU 111. It is also assumed that the TFRG will accept the GoldSim PA modeling and agree that TRU material in Trench T04C and the GCD borings can be closed in place.

Other closure planning assumptions include:

- A Closure Plan and Addenda will be developed for that part of the Area 5 RWMS 92-Acre Area due to be closed in 2010. The core report will primarily address the CAU 111 Closure Unit.

- Through Addenda, the core report will address closure requirements specific to the LLW Unit, the Asbestiform Unit, the TRU GCD Borehole Unit, and the TRU Trench Unit.

- A separate Addendum will update the existing *Pit P03U Mixed Waste Disposal Unit Closure and Post-Closure Care Plan* (NNSA/NSO, 2005a).

Preliminary design work and development of the Closure Plan are proceeding, but several issues need to be resolved (see Section 3.4).

3.4 SPECIAL ISSUES

3.4.1 Empty and Inactive GCD Boreholes

The four empty GCD boreholes (GCD-08C, GCD-09U, GCD-11U, and GCD-12U) will need to be filled with soil or waste and soil prior to or concurrent with construction of the final cover. Also, GCD-06U and GCD-07C, two inactive boreholes containing waste, will have to be filled with soil prior to or concurrent with construction of the final cover. The other GCD boreholes were previously filled to ground surface with clean native soil. The fill method should minimize voids and bridging to minimize potential future settling of the final cover.

3.4.2 Classified Material

Ten trenches and five GCD boreholes within the 92-Acre Area contain classified materials (T01C, T02C, T03C, T04C, T04C-1, T05C, T06C, T07C, T08C, T09C, GCD-01C, GCD-02C, GCD-03C, GCD-04C, and GCD-07C). All of these classified material storage units have been covered or filled with soil. A sixth GCD borehole, GCD-08C, was designated for classified material but never used.

Although the NNSA/NSO handles classified material in accordance with the *Nevada Test Site Waste Acceptance Criteria* (NNSA/NSO, 2005b) and manages the classified materials in storage similar to its equivalent waste classification, it does not regulate radioactive classified material as waste (DOE Nevada Operations Office [DOE/NV], written communication to DOE complex staff, December 21, 2000). For security, classified materials are considered to be stored

indefinitely and must be retrievable, although there is not likely to be a need to move the material while there is federal institutional control of the NTS. The classified materials in the 92-Acre Area will be considered retrievable after placement of the final cover, unless they are declassified or the level of protection required for this material is changed.

The strategy for closure assumes that:

- The classified material will not be declassified.
- Security with respect to the closure-planning process will be limited to the same considerations as the unclassified waste cells for protection from inadvertent intruders.
- The TFRG will accept the position of the NNSA/NSO that classified TRU materials in GCD boreholes and the T04C trench will be closed in place, but subject to potential retrieval in accordance with a retrieval plan.
- The LFRG will accept that classified material in the LLW Unit will be closed in place, but subject to potential retrieval.

3.4.3 TRU Material in Trench T04C

In 1986, 102 containers of classified TRU materials from Rocky Flats Plant were disposed inadvertently in Trench T04C. The original T04C trench was later bisected by Trench T09C and the east side of Trench T04C was eventually redesignated Trench T04C-1. Although disposal of the TRU materials precedes the current surveyed grid system for container locations within waste cells, photographs indicate that the drums are in the west half of the original trench.

Shallow burial of these TRU materials does not meet the DOE M 435.1 Part P requirement that TRU be disposed in accordance with Title 40 CFR 191. Crowe (2006) identified remediation options and made the preliminary recommendation, pending risk management evaluation and decision-making by the NNSA/NSO, to leave the material in place and conduct a PA of the safety requirements of Title 40 CFR 191, with DOE self-regulation. Crowe (2006) further suggested that the LFRG be used to revise the LLW review criteria for applicability to TRU and that the TFRG be appointed to assess the modified review criteria against the GCD TRU PA.

Title 40 CFR 191 Subpart B includes containment, individual protection, groundwater protection, and assurance requirements. The groundwater protection requirements are deemed not to apply to TRU material in the trench because there is no groundwater pathway under foreseeable climate conditions. The Area 5 RWMS probabilistic PA model can be modified and used to evaluate the TRU materials with respect to the containment, individual protection, and assurance requirements.

Waste shipment records indicate the mass of TRU materials in the trench is small: 2.6 pounds, with approximately 230 Curies of activity. The Area 5 RWMS CA (BN, 2000) takes into account the contribution of this TRU inventory. Partly because the EPA defines release limits scaled to the inventory, the containment criteria under Title 40 CFR 191 are relatively conservative for small volumes of TRU inventory. If initial screening of the TRU material in the trenches using the modified probabilistic model indicates that the existing containment is not sufficient to meet the containment criteria, further assessment may be required to define the design for the final cover system.

Assumptions supporting the closure strategy for waste disposal unit Trench T04C include:

- A probabilistic (GoldSim) model will be developed for the TRU material in the trench to contribute to the PA of the trench.

- Results of the probabilistic modeling and existing characterization information will be sufficient to demonstrate compliance with performance objectives, confirm compliance with assurance requirements, and confirm natural and potential engineered barriers are adequate.

- Although PA work to date indicates that no engineered barrier is required to maintain performance through the compliance period, it is assumed that a supplemental engineered barrier consisting of a no more than 1-ft-thick cement cap will be adequate and accepted by the TFRG to meet engineered barricade requirements of Title 40 CFR 191.14.

3.4.4 TRU and MTRU Materials in GCD Boreholes

Chu and Bernard (1991) reviewed records and prepared an inventory and preliminary source term model for materials regulated by Title 40 CFR 191 in the GCD boreholes. Boreholes GCD-01C, GCD-02C, and GCD-03C contain TRU nuclear weapon accident residues, and GCD-04C includes TRU materials from the DOE Rocky Flats Plant.

RCRA mixed waste munitions exemptions do not apply to nuclear weapons. The GCD-01C inventory includes two containers that reportedly contain lithium deuteride and the GCD-04C inventory includes one container with lithium hydride. Both substances are reactive with water. The GCD-03C inventory includes melted high explosives, but the current hazard characteristics are unknown. Based on the findings of Chu and Bernard (1991), GCD-01C and GCD-04C contain MTRU and GCD-03C may contain MTRU. Borehole GCD-02C is suspected to contain MTRU because the inventory is similar to that in GCD-03C; however, this cannot be confirmed. The assumption is that these four GCD boreholes will have to meet both RCRA and Title 40 CFR 191 requirements in accordance with DOE M 435.1-1. The hazardous constituents will be treated as if regulated under RCRA, although the NNSA/NSO does not consider the classified materials to be disposed waste.

In July 2000, NNSA/NSO issued a PA of TRU wastes in the GCD boreholes at the NTS. The DOE TFRG found that additional information was required to meet the assurance requirements of Title 40 CFR 191.14 (DOE/NV, 2001). All of the identified information needs are being addressed through the PA/CA activities and development of the Closure Plan. The review team noted that the disposal system should not preclude removal of waste and specified that additional information regarding retrieval of the materials be added to the PA. The details of the institutional controls, post-closure monitoring, and passive institutional controls via markers and records will be in the Closure Plan.

Title 40 CFR 191 specifies that "disposal systems shall incorporate engineered barrier(s) designed to prevent or substantially delay the movement of water or radionuclides toward the accessible environment." Crowe (2006) recommended that a probabilistic GoldSim model for the requirements of Title 40 CFR 191 be developed using the latest advection and biotic transport data. If the probable releases from the GCD boreholes over the compliance interval are small, it may be possible to demonstrate that design of an additional engineered barrier system is not warranted or cost-effective for this site. It is anticipated based on the probabilistic release models that 70 ft of backfill and a final, monolayer soil cover will provide adequate assurance of containment. However, current plans assume that a 1-ft-thick cement cap will be installed over the four TRU and MTRU boreholes and that the TFRG will approve this engineered barrier.

3.4.5 Corrective Action Unit 111

CAU 111 consists of 10 pits and trenches within the 92-Acre Area; all of these pit and trenches are covered with soil. The disposal units in CAU 111 were in use prior to promulgation of the RCRA. Most of the pits and trenches are known or suspected to contain hazardous constituents; however, based on waste receipt records, none of the pits and trenches received TRU waste. Closure of the CAU 111 pits and trenches must meet the requirements of DOE orders and the FFACO.

Characterization of the Area 5 RWMS was conducted over several decades to fulfill multiple management and compliance objectives. Although some of the site characterization work predates the FFACO and was not tailored to those processes, the characterization is thorough, and the results fulfill the purpose (if not the precise format) of the FFACO document process.

The FFACO process provides a framework for documenting corrective actions. For CAU 111, the corrective action is closure in place of the landfill waste, which was profiled and disposed in accordance with the pertinent regulations of the time. The existing interim soil covers are approximately 8 ft thick. Although this thickness of soil provides adequate containment of the radioactive constituents based on the Area 5 RWMS PA (Shott et al., 1998), a greater thickness of soil will preclude migration of moisture to the waste zone prior to placement and vegetation of the final closure cover. Further, integration of the soil covers on the disposal/storage units will provide appropriate drainage of the site. The final closure cover will be filled, graded, and

vegetated (as needed) to achieve the performance objectives. The closure cover and post-closure management of the CAU 111 landfill cells must continue to demonstrate compliance with RCRA and DOE post-closure performance requirements.

4.0 INTERIM SOIL COVERS AND FINAL COVER DESIGN

The final closure cover will be a monolayer-evapotranspiration (ET) type designed specifically for the arid climate of the NTS. A monolayer-ET cover design has been successfully applied at CAU 110 (the Area 3 U-3ax/bl disposal unit) and CAU 417 (Central Nevada Test Area).

The interim soil covers and final closure covers will be constructed of locally derived native soil. The Area 5 RWMS Disposal Authorization Statement specifies that the final closure cover for the shallow pits and trenches will be at least 13 ft thick, including the interim soil fill. Preliminary modeling to determine an optimal cover thickness has been completed (BN, 2005c). Additional cover optimization modeling will be performed to take into account the latest inventory data. The LFRG and TFRG will review the final cover design with respect to meeting performance objectives.

The interim soil fill above the waste in the GCD boreholes will be at least 70 ft. An addendum to the Area 5 RWMS 92-Acre Area Closure Plan will address closure of the TRU- and MTRU-containing GCD boreholes, including the Title 40 CFR 191 engineered barrier requirements.

As part of ongoing Area 5 RWMS operations in the Expansion Area, the NNSA/NSO plans to use the materials excavated for new pits to continue to thicken the interim soil covers in the 92-Acre Area and fill spaces between disposal units. Grading will be conducted as needed to ensure proper drainage throughout the facility. Borrow material for these soil-cover improvements will not be screened to remove cobble- or larger-sized rocks. Borrow material for the final closure cover will be derived from existing stockpiles and, as necessary, a new borrow pit in the Expansion Area of the Area 5 RWMS. Any new borrow sources will be designed to meet quantities estimated in the title design of the final closure covers. Borrow material for the final cover will be screened to remove any rocks larger than 6 inches. Construction of the final closure cover will include placing the screened native fill, grading, and vegetating.

Assumptions related to final disposition of TRU materials, and design and construction of the final closure covers include:

- The TFRG will accept closure in place for all buried TRU materials.
- The optimum final cover will be less than 13 ft thick, including the interim soil cover.
- The final closure cover for the GCD boreholes containing TRU or MTRU materials may include an engineered barrier to meet Title 40 CFR 191 assurance requirements.

- The TFRG will accept a 1-ft-thick cement cap as an engineered barrier.

- The NDEP will accept improvements to the interim soil covers to finish integrating them.

- Any geotechnical evaluation of borrow materials required by NSTec Engineering for design of the final closure cover will be based on existing data.

5.0 CLOSURE SCHEDULE

Activities associated with the final closure of the 92-Acre Area of the Area 5 RWMS started in fiscal year (FY) 2005 and are anticipated to be completed by FY 2011, assuming allocation of budget for closure by the DOE. The Closure Plan and Addenda for the 92-Acre Area, excluding the Pit P03U MWDU, are scheduled to be written in FY 2007 and FY 2008 and implemented in FY 2010. The Closure Report for the 92-Acre Area, excluding the Pit P03U MWDU, is scheduled to be completed in FY 2011. The Closure Plan for the Pit P03U MWDU is scheduled to be updated in FY 2010 and implemented in FY 2011. The Closure Report for the Pit P03U MWDU is scheduled to be completed in FY 2011. Most of the planning will be completed by the end of FY 2008, followed by a hiatus in activities in FY 2009 while the NNSA/NSO continues to seek funding for closure construction.

Preliminary internal (NSTec) schedule milestones include:

- Complete title closure cover design for the Area 5 RWMS 92-Acre Area.

- Complete a draft Closure Plan for the CAU 111 and Addenda for the LLW Unit, Asbestiform LLW Unit, TRU GCD Borehole Unit, and the TRU Trench Unit.

- Submit the draft Closure Plan for the CAU 111 and Addenda for the TRU GCD Borehole Unit and the Asbestiform LLW Unit to the NNSA/NSO and the NDEP for review.

- Complete a final Closure Plan for the CAU 111 and Addenda for the LLW Unit, Asbestiform LLW Unit, TRU GCD Borehole Unit, and the TRU Trench Unit, and submit to the NNSA/NSO and the NDEP for acceptance.

- Submit the draft Closure Plan Addendum for the TRU GCD Borehole Unit and the TRU Trench Unit to the NNSA/NSO and the TFRG for review.

- Complete the final Closure Plan Addendum for the TRU GCD Borehole Unit and the TRU Trench Unit to the NNSA/NSO and the TFRG for acceptance.

- Acquire funding for implementation of all Closure Plans and all Addenda.

- Complete implementation of the Closure Plan (closure cover construction) for the CAU 111 and Addenda Units.

- Complete a Closure Report for the CAU 111 and Addenda Units and submit to the NNSA/NSO and NDEP for review and acceptance.

- Complete a draft Closure Plan for the Pit P03U MWDU.

- Submit the draft Closure Plan for the Pit P03U MWDU to the NNSA/NSO and the NDEP for review.

- Complete a final Closure Plan for the Pit P03U MWDU and submit to the NNSA/NSO and the NDEP for acceptance.

- Complete implementation of the Closure Plan (closure cover construction) for the Pit P03U MWDU.

- Complete a Closure Report for the Pit P03U MWDU and submit to the NNSA/NSO and NDEP for review and acceptance.

- Start post-closure maintenance and monitoring of the Area 5 RWMS 92-Acre Area in accordance with Closure Plans and Addenda.

6.0 NEAR-TERM ACTIONS

Near-term actions relevant to closure of the Area 5 RWMS 92-Acre Area include:

- Brief the NDEP on the closure strategy and continue interaction to ensure progress toward meeting closure objectives.

- Obtain acceptance of the Area 5 RWMS 92-Acre Area Characterization Report by the NDEP to allow development of a Closure Plan and Addenda.

- Place soil to improve performance of interim soil covers and ensure appropriate site drainage.

- Conduct the TRU PA for GCD and Trench T04C to demonstrate meeting performance objectives for closure in place.

- Develop preliminary retrieval plan for TRU (perhaps as part of PA) to satisfy TFRG requirements.

- Complete an updated flood assessment to ensure appropriate design of the final closure cover for control of precipitation run-on and runoff.
- Conduct final closure cover optimization modeling to ensure efficient design.
- Complete title closure cover design for inclusion in the Closure Plan.
- Start development of Closure Plan and Addenda as required by the EPA and DOE.
- Complete nuclear facility hazard assessment required for facility closure.
- Update the ICMP as required by DOE order and the Disposal Authorization Statement.
- Continue review and publication of historical technical documents to ensure availability of data used in closure documents.

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